Wherefore, what is claimed is:

1. A system for generating a high dynamic range (HDR) image from an image sequence of a scene captured while varying the exposure of each image, comprising:

a general purpose computing device;

a computer program comprising program modules executable by the computing device, wherein the computing device is directed by the program modules of the computer program to,

designate the image having the greatest number of valid pixels as a reference image, wherein a pixel is valid if it is not saturated and it exhibits an acceptable degree of contrast,

for each image except the reference image, register the image under consideration with the image, including the reference image, which exhibits an exposure that is both closer to that of the reference image than the image under consideration and closest among the images to the exposure of the image under consideration, to generate a flow field,

concatenate the flow fields generated for the non-reference images not already registered with the reference image, to register each of them with the reference image,

warp each non-reference image using the flow field associated therewith, and

combine the reference image and the warped images to create a radiance map representing the HDR image.

2. The system of Claim 1, further comprising a program module for tone mapping the radiance map to convert it into an 8-bit representation suitable for rendering.

3. The system of Claim 2, wherein the program module for tone mapping the radiance map, comprises sub-modules for:

converting the radiance map to CIE space and recovering the chromaticity coordinates to produce a luminance image;

compressing the dynamic range of the luminance image and re-inserting the chrominance; and

converting the CIE space image to produce the final 8-bit RGB image.

4. The system of Claim 1, wherein the number of images in said sequence of images and the variation in the exposure among the images is such that the images collectively capture substantially all the brightness variation of the scene depicted in the images.

5. The system of Claim 1, wherein the intensity of a pixel is measured in terms of 8-bit RGB color space values, and wherein a pixel is considered as being unsaturated and exhibiting the acceptable degree of contrast if each of its RGB values is within a prescribed interval.

6. The system of Claim 5, wherein the prescribed interval is between, and including, 17 and 254..

7. The system of Claim 1, wherein the sub-module for registering the image under consideration with the image exhibiting the exposure that is both closer to that of the reference image than the image under consideration and closest among the images to the exposure of the image under consideration, to generate a flow field, comprises sub-modules for:

whenever the image under consideration has a shorter exposure than the other input image it is being registered with,

boosting the intensity of the image under consideration to substantially match the intensity range of said other input image,

computing a flow field that globally registers the image under consideration with said other input image by estimating a global transform that maps the image under consideration onto that other image; and

computing a dense motion field, which forms a local correction to the flow field computed with the global transform, using a gradient based optical flow; wherein

the corrected flow field comprises a composite vector for each pixel location of the flow field which is the sum of (i) the global component derived from said global transform, and (ii) a local component taken from said dense motion field that forms the local correction for the global component.

8. The system of Claim 7, wherein the sub-module for computing a dense motion field that forms a local correction to the global transform using a gradient based optical flow, comprises sub-modules for:

employing a variant of the Lucas and Kanade technique used in a Laplacian pyramid framework wherein the image under consideration is warped towards said other input image and the residual flow vectors are estimated at each level of the pyramid; and

accumulating the residual flow vectors computed for each pixel at each level of the pyramid to establish said local component of the dense motion field.

9. The system of Claim 1, wherein the sub-module for registering the image under consideration with the image exhibiting the exposure that is both closer to that of the reference image than the image under consideration and closest among the images to the exposure of the image under consideration, to generate a flow field, comprises sub-modules for:

whenever the image under consideration has a longer exposure than the other input image it is being registered with,

boosting the intensity of said other image to substantially match the intensity range of the image under consideration,

computing a flow field that globally registers the image under consideration with said other input image by estimating a global transform that maps the image under consideration onto that other image; and

computing a dense motion field, which forms a local correction to the flow field computed with the global transform, using a gradient based optical flow; wherein

the corrected flow field comprises a composite vector for each pixel location of the flow field which is the sum of (i) a global component derived from said global transform, and (ii) a local component taken from said dense motion field that forms the local correction for the global component.

10. The system of Claim 9, wherein the sub-module for computing a dense motion field that forms a local correction to the global transform using a gradient based optical flow, comprises sub-modules for:

employing a variant of the Lucas and Kanade technique used in a Laplacian pyramid framework wherein the image under consideration is warped towards said other input image and the residual flow vectors are estimated at each level of the pyramid; and

accumulating the residual flow vectors computed for each pixel at each level of the pyramid to establish said local component of the dense motion field.

11. The system of Claim 1, wherein the program module for combining the reference image and warped images to create the radiance map, comprises sub-modules for:

converting the reference image and each warped image, respectively, to radiance images; and

assigning a radiance value to each pixel location in the radiance map, wherein said radiance map radiance value is the radiance value assigned to the same pixel location in the radiance image associated with the reference image or a weighted combination of two or more radiance values taken from the

corresponding pixel locations in the radiance images associated with the reference image and the warped images, depending on which values are deemed to be trustworthy based on the intensity of the pixel at that pixel location in the reference image.

12. A computer-implemented process for generating a high dynamic range (HDR) image from an image sequence of a scene captured while varying the exposure of each image, said process comprising using a computer to perform the following process actions:

inputting said images;

designating the input image having the greatest number of valid pixels as a reference image, wherein a pixel is considered valid if it is not saturated and it exhibits a prescribed degree of contrast;

for each input image except the reference image, identifying corresponding pixels between the image under consideration and another input image, including the reference image, which exhibits an exposure that is both closer to that of the reference image than the input image under consideration and closest among the input images to the exposure of the input image under consideration;

using the pixel correspondences identified between pairs of input images to establish a set of corresponding pixels among the input images for each pixel of the reference image; and

for each set of corresponding pixels, identifying at least one pixel in the set that represents a trustworthy pixel and employing the pixel color information associated with the one or more identified trustworthy pixels to compute a radiance value for that set of pixels to form a radiance map representing the HDR image.

13. The process of Claim 12, further comprising a process action of tone mapping the radiance map to convert it into an 8-bit representation suitable for rendering.

14. The process of Claim 12, wherein the process action of identifying corresponding pixels between the image under consideration and said other input image, comprises an action of computing a flow field that registers that image with said other input image.

15. The process of Claim 14, wherein the process action of using the pixel correspondences identified between pairs of input images to establish a set of corresponding pixels among the input images for each pixel of the reference image, comprises an action of concatenating the flow fields generated for the non-reference images not already registered with the reference image to register each of them with the reference image.

16. The process of Claim 14, wherein the process action of, for each set of corresponding pixels, identifying at least one pixel in the set that represents a trustworthy pixel and employing the pixel color information associated with the one or more identified trustworthy pixels to compute a radiance value for that set of pixels to form a radiance map representing the HDR image, comprises the actions of:

converting the reference image and each warped image, respectively, to radiance images; and

for each of pixel location of the reference image,

determining if the radiance values assigned to the corresponding location in the warped images are within a maximum allowable noise variance of the radiance value assigned to pixel location of the reference image under consideration,

whenever it is found that at least one of the radiance values assigned to said corresponding location in a warped image is within the maximum allowable noise variance of the radiance value assigned to the pixel location in the reference image under consideration, computing a weighted average of radiance values assigned to the pixel location of the reference frame

under consideration and said corresponding pixel location in the warped images whose radiance values fell within the maximum allowable noise variance, and assigning the weighted average as the radiance value for the pixel location under consideration in the radiance map, and

whenever it is found that none of the radiance values assigned to said corresponding locations in the warped images are with the maximum allowable noise variance of the radiance value assigned to the pixel location in the reference image, assigning the radiance value assigned to the pixel location under consideration in the reference image as the radiance value for the pixel location under consideration in the radiance map.

17. The process of Claim 16, wherein the process action of computing a weighted average of radiance values assigned to the pixel location of the reference frame under consideration and said corresponding pixel location in the warped images whose radiance values fell within the maximum allowable noise variance, comprises an action of computing the weighted average radiance as

$$R_{wavg} = \frac{f_{WM}(p_R, p_{S_1}) p_{S_1} .. + .. f_{WM}(p_R, p_{S_n}) p_{S_n} + f_{WM}(p_R, p_{L_1}) p_{L_1} .. + .. f_{WM}(p_R, p_{L_n}) p_{L_n} + f_W(p_R) p_R}{f_{WM}(p_R, p_{S_1}) .. + .. f_{WM}(p_R, p_{S_n}) + f_{WM}(p_R, p_{L_1}) .. + .. f_{WM}(p_R, p_{L_n}) + f_W(p_R)},$$

wherein p_R, P_{Si} and p_{Li} are corresponding pixels in the radiance images with subscript R referring to the radiance image associated with the reference image, subscript S_i referring to the radiance images associated with each of the warped images having an exposure shorter than the reference image and subscript L_i referring to the radiance images associated with each of the warped images having an exposure longer than the reference image, and wherein the weighting function $f_{WM}(q,p) = f_M(|p-q|) f_W(p)$ is an intensity-based weight function f_W modulated by a plausibility map f_M, where $f_M()$ is a Hermite Cubic defined by

$$f_M(\delta) = \begin{cases} 2\left(\frac{\delta}{\delta_{\max}}\right)^3 - 3\left(\frac{\delta}{\delta_{\max}}\right)^2 + 1 & \text{if } \delta < \delta_{\max} \text{ and } \delta_{max} \text{ is a prescribed parameter,} \\ 0 & \text{otherwise} \end{cases}$$

such that the modulated weight of a radiance value associated with a warped

image that is outside said maximum allowable noise variance is set to zero when calculating the weighted average radiance.

18. A computer-readable medium having computer-executable instructions for generating a high dynamic range (HDR) image from a sequence of bracketed images, said computer-executable instructions comprising:

(a) inputting said bracketed images;

(b) sorting the input images in the order of their exposures;

(c) designating the input image having the greatest number of valid pixels as a reference image, wherein a pixel is valid if it is not saturated and it exhibits a prescribed degree of contrast;

(d) selecting a previously unregistered non-reference input image;

(e) determining whether the selected input image has an exposure that is shorter or longer than the reference image;

(f) whenever the selected input image has an exposure that is shorter than the reference image,

identifying the input image having the next shortest exposure that is still longer than the selected input image, which could be the registered image,

boosting the selected image to match the exposure of the identified image,

registering the boosted selected image with the identified image, to generate a flow field for the selected image;

(g) whenever the selected input image has an exposure that is longer than the reference image,

identifying the input image having the next longest exposure that is still shorter than the selected input image, which could be the registered image,

boosting the identified image to match the exposure of the selected image,

registering the selected image with the boosted identified image, to generate a flow field for the selected image;

(h) determining if there are any remaining unregistered non-reference input images, and if so repeating instructions (d) through (h) until all the non-reference images have been registered;

(i) concatenating the flow fields generated for the non-reference input images not already registered with the reference image to register each of them with the reference image;

(j) warping each non-reference input image using the flow field, or concatenated flow field if one, associated therewith; and

(k) combining the reference image and the warped images to create a radiance map representing the HDR image.

19. The computer-readable medium of Claim 18, further comprising an instruction for tone mapping the radiance map to convert it into an 8-bit representation suitable for rendering.

20. The computer-readable medium of Claim 18, wherein the intensity of a pixel is measured in terms of 8-bit RGB color space values, and wherein a pixel is considered as being unsaturated and exhibiting the acceptable degree of contrast if each of its RGB values is between, and including, 17 and 254.